DRAFT TECHNICAL ADDENDUM
RAYMARK – SHORE ROAD
STRATFORD, CONNECTICUT

Raymark 005
2.2
10885

1.0 INTRODUCTION

This Technical Addendum supplements the Draft Final Engineering Evaluation/Cost Analysis (EE/CA) Report dated June 1999, and a Draft Addendum dated July 1999. These two documents were prepared by Tetra Tech NUS, Inc. (TtNUS) for EPA under Contract No. 68-W6-0045, Work Assignment No. 035-NSEE-01H3, to evaluate options for a Non-Time-Critical Removal Action (NTCRA) for the Raymark-Shore Road Study Area in Stratford, Connecticut. EPA has determined that a NTCRA is needed to protect human health and the environment from contaminated soil-waste/fill materials that are believed to have originated at the former Raymark Facility.

This Technical Addendum supplements Alternative No. 3 by providing a treatment step after excavation of soils and prior to off-site transport. All other information in the EE/CA will remain unchanged. At the direction of EPA, this Addendum only addresses two soil treatment options. All figures and appendices referenced in the Draft Final EE/CA remain the unchanged. The cost tables have been revised and are included in this Addendum.

The EE/CA evaluated three excavation options while the Addendum evaluated a capping option. The excavation and the capping options would address the contaminants of concern (comprising lead, asbestos, PCBs, and dioxins) and would meet the removal action objectives:

- Prevent direct human contact with contaminants in soil-waste/fill materials.
- Prevent, to the extent practicable, the further release of contaminants from soil-waste/fill materials into the soil, groundwater, surface water, and sediments.
- Prevent, to the extent practicable, the release of contaminants from the soil-waste/fill into the Housatonic River that occurs through flooding.
- Prevent, to the extent practicable, continued ecological impacts from the release of contaminants from the soil-waste/fill into the Housatonic River and nearby wetlands.

At the request of EPA, options for treating the contaminated soil-waste/fill materials were reconsidered and developed. The treatment processes reconsidered in this letter report were vitrification (thermal treatment) and solidification/stabilization. After review of the vitrification and solidification/stabilization processes, only solidification/stabilization was retained for further evaluation. Detailed discussions of these two processes are provided below in Sections 2.0 and 3.0

2.0 VITRIFICATION

Vitrification is the process by which energy is applied and used to heat the soil-waste/fill material to elevated temperatures (> 1300 degrees C) where soil and contaminants are melted. Upon cooling, a glass-like material is formed that locks the metals into its matrix. Organic compounds are destroyed at the high temperatures. Vitrification can meet the removal action objectives.

Vitrification can be conducted in-situ by placing electrodes into the ground and supplying electrical energy to heat and melt the contaminated soils. In-situ vitrification (ISV) has been demonstrated, but has not been widely used at sites. Ex-situ vitrification can also be conducted using a transportable system, which has a maximum capacity of only 300 pounds per hour (roughly 1.2 tons per 8-hour working day). Pilot testing has been conducted using the transportable system; this system is primarily being tested for low-level radioactive and mixed waste materials. Energy costs are expected to be high because of the extremely high temperatures required to melt the soils.

In summary, for the Shore Road Study Area, ex-situ vitrification would be more appropriate then in-situ because of the shallow depths to the water table (only 5.5 feet). However, because of the shallow water table, much more energy will need to be applied to heat the soil-waste/fill to the desired temperatures. Considering the high energy costs and the low treatment rate (less than 1.2 tons per day), vitrification is not a cost-effective option for the Shore Road Study Area and will not be considered further at this time.

3.0 SOLIDIFICATION/STABILIZATION

Solidification/stabilization is an ex-situ treatment process where contaminated soils are mixed with reagents to mechanically lock the soils and contaminants into a solid matrix. The contaminants are not altered chemically, but are immobilized because the soils to which they are adsorbed are bound into a soil-cement matrix. Solidification/stabilization of contaminated soil-waste/fill materials would meet the removal action objectives identified above.

Cement is typically used as the solidification/stabilization reagent because of its low cost, relative availability, and ease of handling. Under certain circumstances, non-proprietary or proprietary reagents may be used to improve the treatment process. Proprietary reagents may cost more to use than cement.

Treatment would consist of batching contaminated soils with cement and allowing the soil-cement mixture to harden. Only common construction equipment and techniques would be required. Solidification/stabilization has been widely used at a number of sites to address metal-contaminated soils. Organics bound to soils can also be immobilized through solidification.

Prior to full-scale treatment, typically bench-scale tests are performed to determine the effectiveness of solidification/stabilization treatment on site-specific soils, to determine the proper soil/cement mix ratios, and other treatment parameters. Such a bench-scale test was completed in 1994 using soil-waste materials from the Raymark Facility and the results are presented in the Final Treatability Study Report for Bench-Scale Solidification and Stabilization (HNUS, 1994). In this bench-scale test, various percentages of cement were added to contaminated soils to evaluate the reduction of lead leaching (lead was, and still is, a primary Contaminant of Concern). Results of the test concluded that adding between 10 to 20 percent (by weight) cement to soils resulted in reducing lead leaching to below the 5 mg/L limit established under 40 CFR 261.24, when subjected to the Toxicity Characteristic Leaching Procedure. Other additives (magnesium oxide, calcium oxide, and trisodium phosphate) were tested in conjunction with cement.

Based on the results of the bench-scale treatability study, it was estimated that up to 500 cubic yards of soils could be treated per day. The treatability study report also concluded that additional testing may be warranted to test mixtures of cement with calcium oxide (lime) to optimize the solidification/stabilization processes.

In summary, for the Shore Road Study Area, on-site ex-situ solidification/stabilization is appropriate because it would meet the NTCRA removal action objectives, the costs are reasonable for a treatment option. The estimated costs to implement this option are presented in Section 4.0.

4.0 SOLIDIFICATION TREATMENT COSTS

As part of this evaluation, EPA requested that solidification/stabilization treatment costs be developed to supplement Alternative 3 (Excavation to 5.5 Foot Depth and Site Restoration) detailed in the EE/CA. Solidification would reduce the mobility of the soil contaminants by binding the lead, asbestos, and organic compounds into a stable soil-cement matrix, and reduce or eliminate the potential leaching of lead from the soils. Two scenarios were considered:

- Scenario 1: Excavating and treating 35,000 cubic yards (CY) of contaminated soils on site, and transporting the approximately 55,000 CY of treated materials to an in-town location for disposition. Costs for transporting those additional cubic yards are presented on Table 2.

- Scenario 2: Excavating and treating 35,000 cubic yards (CY) of contaminated soils, backfilling approximately 16,000 CY of treated materials from 5.5 to 3 feet below ground surface (the assumed frost penetration depth), and transporting the remaining approximately 39,000 CY of treated materials to an in-town location for disposition. Costs for transporting these additional cubic yards are presented on Table 3.

Full-scale solidification/stabilization would generally consist of the following components:

- Perform pilot testing to refine bench-scale testing results and to optimize cement/additive/soil-waste mixture ratios, and assess volume increases (due to cement addition).
- Prepare treatment and disposal designs.
- Excavate contaminated soil-waste materials to a depth of 5.5 feet.
- Employ dust suppression during excavation (water spray, foams, or tackifiers), and controlling fugitive dusts during transport (covering, wetting, etc.).
- Transport excavated soils to treatment system, which is situated nearby on site; process materials through screens to remove oversized materials.
- Place screened soils into pugmill where they are mixed with cement and other reagents.
- As necessary, perform verification testing (i.e., TCLP, etc.) on representative samples of the treated materials.
- Convey treated materials to desired locations. Treated materials will be wetted by cement mixture. Covered trucks or cement trucks will be used to transport treated materials.
- Allow the soil-cement mixture to set and harden.
- Cover the treated materials with appropriate materials.
- Perform verification sampling of excavated areas prior to backfilling the Shore Road Study Area.

A full-scale ex-situ solidification/stabilization system would be designed to process an estimated 250 to 500 cubic yards per day of soil-waste materials. Considering the need to exercise dust control (using water sprays, foams, or other chemical agents), the effective production rate may be less. The system would be established at the Shore Road Study Area, and would include the following equipment and facilities:

- Excavation equipment such as backhoes and bulldozers to remove the contaminated soil-waste/fill materials from their present location.
- Transportation equipment such as trucks, front-end loaders, and conveyors to transfer the soil-waste/fill materials.

- Treatment equipment including power screens to remove fragments larger than 2 inches from the soil-waste/fill material prior to blending with treatment additives in the pugmill or mixing muller.

- Support equipment such as additive storage silos, feed hoppers, blenders, truck scales, and power generators.

- Support facilities such as storage and project administration trailers, decontamination facilities, and sanitary facilities.

- Utilities including electricity and service water for treatment and misting for dust control purposes.

Four work areas would be established at the Shore Road Study Area to support the treatment:

- An untreated soil-waste/fill materials stockpile area for staging prior to treatment.

- A treatment area where the contaminated soil-waste materials are blended with the solidification additives [cement, calcium oxide, TSP].

- A treated materials stockpile area for staging prior to transport to an in-town location, or transport back into the excavated areas.

- A support area for decontamination of equipment and personnel, storage of equipment, and other support activities.

The estimated costs for the two scenarios were developed using the following assumptions:

- No additional pre-treatment or treatment will be required to effect solidification/stabilization. Pilot test results may indicate additional treatment steps.

- Dust suppression chemicals do not affect solidification/stabilization processes. This will be verified during pilot testing.

4.1 Scenario 1 Cost Estimate

Under this Scenario, soils would be excavated and treated and transported to an in-town location for disposition. The total estimated cost is approximately $8.4 million, as presented on Tables 1 and 2

4.2 Scenario 2 Cost Estimate

Under this Scenario, soils would be excavated and treated and transported to an in-town location for disposition. The total estimated cost is approximately $7.7 million, as presented on Tables 1 and 3.

TABLE 1
CAPITAL COSTS for
ALT. NO. 3, SCENARIO 1 - SOLIDIFICATION/STABILIZATION
RAYMARK - SHORE ROAD
STRATFORD, CONNECTICUT

			Unit Cost ($)				Total Cost ($)				Total Direct Cost, 1999 ($) [1]
Item	Qty	Unit	Sub.	Mat.	Labor	Equip.	Sub.	Mat.	Labor	Equip.	(Total Cost x 1.1)
SOLIDIFICATION/STABILIZATION											
1) Excavate contaminated soil (already accounted for in EE/CA es	35,000	CY			0.00	0.00			0	0	0
2) Haul excavated materials to treatment area (w/25% swell facto	43,750	CY			0.46	1.26			20,125	55,125	82,775
3) S/S Equipment											0
equipment mob.	1	ea				50000			0	50,000	55,000
vibrating screens	17	wk				1500			0	25,500	28,050
conveyor belts (2 sets)	2	ea				6000			0	12,000	13,200
S/S batch plant	1	ea				200000			0	200,000	220,000
water system for batch plant	1	ea				2900			0	2,900	3,190
waste/slurry pumps (2)	2	ea				3000			0	6,000	6,600
dust collection system	1	ea				7300			0	7,300	8,030
ancillary equip.	1	ea				7200			0	7,200	7,920
truck scale rental	5	MO				2800			0	14,000	15,400
pressure washer	1	ea				9000			0	9,000	9,900
portland cement (@ 10% weight of 52500 tons)	77.73	ton				5250			0	408,083	448,891
lime (@ 5% of weight of 52500 tons)	98.00	ton				2625			0	257,250	282,975
4) dust suppression	1	LS	20,000								
5) Site labor											
laborers	3,600	hr			20.00				72,000	0	79,200
supervisor	1,200	hr			28.00				33,600	0	36,960
6) load to trucks (treated soils bulking by 25%)	54,375	CY			0.46	1.26			25,013	68,513	102,878
7) haul to in-town disposal location (already accounted for in EE/C	54,375	CY			0.00	0.00			0	0	0
8) Home office support	500	hr	75				37,500		0	0	41,250
Subtotal of Total Direct Costs							37,500	0	150,738	1,122,870	1,442,218
Safety Level (C) Multiplier (30% of labor & equipment)									45,221	336,861	382,082
Total with Safety Multiplier							37,500	0	195,959	1,459,731	1,862,509
Burden @ 30% of Labor Cost									58,788		64,666
Labor @ 10% of Labor Cost									19,596		21,555
Material @ 10% of Material Cost								0			0
Subcontract @ 5% of Sub. Cost							1,875				2,063
Total Direct Cost							39,375	0	274,342	1,459,731	1,950,793
Indirect @ 75% of Total Direct Labor Cost									205,757		226,332
Profit @ 5% of Total Direct Cost											97,540

TABLE 1
CAPITAL COSTS for
ALT. NO. 3, SCENARIO 1 - SOLIDIFICATION/STABILIZATION
RAYMARK - SHORE ROAD
STRATFORD, CONNECTICUT

			Unit Cost ($)				Total Cost ($)				Total Direct Cost, 1999 ($) [1]
Item	Qty	Unit	Sub.	Mat.	Labor	Equip.	Sub.	Mat.	Labor	Equip.	(Total Cost x 1.1)
Sub Total: Direct, Indirect, Profit											2,274,665
Health & Safety Monitoring @ 2%											45,493
Total Field Cost											2,320,158
Contingency @ 20% of Total Field Cost											464,032
Engineering @ 1% of Total Field Cost											23,202
Total Cost											2,807,392

Notes:

TABLE 2
REVISED ALT. 3 - SCENARIO 1
EXCAVATION, HAULING AND SITE RESTORATION
RAYMARK - SHORE ROAD
STRATFORD, CONNECTICUT

			Unit Cost ($)				Total Cost ($)				Total Direct Cost, 1999 ($) [1]
Item	Qty	Unit	Sub.	Mat.	Labor	Equip.	Sub.	Mat.	Labor	Equip.	(Total Cost x 1.1)
MOBILIZATION/DEMOBILIZATION											
1) Office trailer (2)	10	MO	1,000				10,000				11,000
2) Storage trailer (1)	10	MO	500				5,000				5,500
3) Construction survey	1	LS	20,000				20,000				22,000
4) Portable communication equipment	4	SETS	1,500				6,000				6,600
5) Equipment mobilization/demobilization	1	LS	30,000				30,000				33,000
6) Site utilities	10	MO	4,000				40,000				44,000
7) Security	10	MO	10,000				100,000				110,000
8) Decontamination trailer	10	MO	1,500				15,000				16,500
DECONTAMINATION FACILITIES AND SERVICES											
1) Laundry service	48	WKS	250				12,000				13,200
2) Truck decon pad (2)											
a) Concrete pad - 8"	80	CY		70	125	5.00		5,600	10,000	400	17,600
b) Gravel base - 6"	60	CY		7.50	3.33	8.00		450	200	480	1,243
c) Curb	240	LF		3.07	1.99	0.05		737	478	12	1,349
d) Collection sump	2	EA		1,450	600	220		2,900	1,000	440	4,774
e) Splash guard	1,560	SF		1.25	1.00			1,950	1,560		3,861
3) Decontamination services	10	MO	1,200				12,000				13,200
4) Decon water	132,000	GAL	0.20				26,400				29,040
5) Personnel decon pad (2)											
a) Concrete pad - 4"	4	CY		70	125	5.00		280	500	20	880
b) Gravel base - 4"	4	CY		7.50	3.33	8.00		30	13	32	83
c) Curb	160	LF		3.07	1.99	0.05		491	318	8	899
6) Clean water storage tank (3000 gals)	2	EA		3,000	300			6,000	600		7,260
7) Spent water storage tank (5000 gals)	2	EA		5,000	400			10,000	800		11,880
LEGAL FEES											
1) Activity use limitations	1	DEED			2,500				2,500		2,500
SITE PREPARATION											
1) Prepare site for excavation at 35% of excavation costs	1	LS	58,616				58,616				58,616
SOIL EXCAVATION[2]											
1) Excavate contaminated soil	35,000	CY			1.74	2.61			60,900	91,350	167,475
2) Hauling excavated and S/S treated materials	55,000	CY			2.23	5.55			122,650	305,250	470,690
3) Backfill with clean soil											
a) Fill material	40,250	CY		18.00				724,500			796,950
b) Place & Spread	40,250	CY			0.51	1.87			20,528	75,268	105,375
c) Compact	40,250	CY			0.03	0.04			1,208	1,610	3,099
4) Sheet piling	4,500	SF	7.89				35,505				39,056
5) Asphalt Removal and Disposal											
a) pavement removal	4,056	SY			2.24	2.37			9,085	9,613	20,568
b) material transport	446	CY			3.00	7.40			1,338	3,300	5,102
c) disposal	446	CY			1.66	3.59			740	1,601	2,576
TEMPORARY STORAGE CELL											
1) Stressed Membrane Structure lease price (88' x 600')	36	MO		19,000				684,000			752,400
2) Material delivery to site	1	LS		9,000				9,000			9,900
3) 6" sand base (88'x 600' x 0.5')	978	CY		10.80				10,562			11,619
4) Geotextile floor (88' x 600')	5,867	SY		1.50				8,801			9,681
5) Erection costs											
a) scaffolding (rent for month)	72	MSF	90				6,480				7,128
b) labor (9 men, 25 days, 8 hr/day)	1,800	HR	25				45,000				49,500
c) construction consultant	1	LS	9,000				9,000				9,900

TABLE 2
REVISED ALT. 3 - SCENARIO 1
EXCAVATION, HAULING AND SITE RESTORATION
RAYMARK - SHORE ROAD
STRATFORD, CONNECTICUT

			Unit Cost ($)				Total Cost ($)				Total Direct Cost, 1999 ($) [1]
Item	Qty	Unit	Sub.	Mat.	Labor	Equip.	Sub.	Mat.	Labor	Equip.	(Total Cost x 1.1)
SITE RESTORATION											
1) Repave Lot	6,400	SF		1.14	0.20	0.17		7,296	1,280	1,088	10,630
2) Parking lot curbs	160	LF		0.47	0.80			75	128		224
3) Repave Shore Rd.											
a) 12" stone base	2,250	SY		15.40	0.58	1.18		34,650	1,305	2,655	42,471
b) 3" binder course	2,250	SY		3.89	0.41	0.35		8,753	923	788	11,509
c) 1" wearing course	2,250	SY		1.53	0.21	0.19		3,443	473	428	4,777
4) Revegetation (Lawns)	70	MSF		18.00	16.50	6.70		1,260	1,155	469	3,172
5) Revegetation (Trees and Shrubs)	25	EA			42.50				1,063		1,169
6) Restore stone/gravel surfaces (4-inch layer)	4,500	SY		7.70	0.35	0.71		34,650	1,575		39,848
7) Replace fence	800	LF		10.20	2.91	1.87		8,160	2,328	1,496	13,182
8) Sliding gate	12	LF		82.50	19.15	12.30		990	230	148	1,504
9) Swinging gate (3' wide)	1	EA		75.00	72.50	46.50		75	73	47	213
10) Rope fence											
a) 4' posts set in concrete	21	EA		6.25	10.25			131	215		381
b) rope	400	LF		3.00				1,200			1,320
11) Replace sidewalks											
a) 6" stone base	1,500	SY		7.70	0.35	0.71		11,550	525	1,065	14,454
b) 4" thick concrete	13,500	SF		0.96	0.97			12,960	13,095	0	28,661
12) Replace rip rap	360	TON		9.00	0.48	1.04		3,240	173	374	4,166
13) Place rip rap w/ heavy equipment	222	CY		15.40	6.70	8.00		3,419	1,487	1,776	7,350
14) Replace timber cribbing w/ concrete blocks											
a) Labor cost for placement (30' x 20')	600	SF			10.95				6,570		7,227
b) Crane rental for moving blocks	1	WK				1300.00				1,300	1,430
UTILITIES											
1) Grinder pump (Environment One model GP 2014-129)	1	EA		7,075.00				7,075			7,783
2) Alarm/Disconnect Panel (Environment One model MOD 260)	1	EA		1,000.00				1,000			1,100
3) Replace power pole	10	EA	1,457.00				14,570				16,027
4) Trenching	800	CY			1.93	1.44			1,544	1,152	2,966
5) Sewer pipe (force main, 1.5" PVC)	1,050	LF		0.93	1.88			977	1,974		3,246
6) Sewer Pipe Fittings (10% of cost of pipe)	1	LS		324.56				325			357
7) Water pipe (31-inch PVC)	1,100	LF		2.07	2.82			2,277	3,102		5,917
8) Water Pipe Fittings (10% of cost of pipe)	1	LS		591.69				592			651
INTERIM CONSTRUCTION MONITORING											
1) Stormwater Sampling	78	HR			25				1,950		2,145
2) Stormwater Analysis	6	EA	2,270				13,620				14,982
3) Air Monitoring (10 hr/wk x 48 weeks)	480	HR			25.00				12,000		13,200
4) Air Sample Analysis (6 @ 48 weeks)	288	EA	350				100,800				110,880
5) Sample Shipping	30	WK	100				3,000				3,300
6) ODCs/M&IE	30	WK				375				11,250	12,375
WELL REPLACEMENT/INSTALLATION											
1) Install 1 monitoring well	1	EA	6,000				6,000				6,600
2) Drilling Oversight	20	HR			25				500		550
3) Oversight ODCs/M&IE	1	LS				800				800	880
4) Construction Survey	1	LS	200				200				220
Subtotal of Total Direct Costs							569,191	1,609,397	288,084	514,218	3,272,868
Safety Level (C) Multiplier (30% of labor & equipment)									85,675	154,265	239,941
Total with Safety Multiplier							569,191	1,609,397	373,759	668,484	3,542,914

TABLE 2
REVISED ALT. 3 - SCENARIO 1
EXCAVATION, HAULING AND SITE RESTORATION
RAYMARK - SHORE ROAD
STRATFORD, CONNECTICUT

			Unit Cost ($)				Total Cost ($)				Total Direct Cost, 1999 ($)[1]
Item	Qty	Unit	Sub.	Mat.	Labor	Equip.	Sub.	Mat.	Labor	Equip.	(Total Cost x 1.1)
Burden @ 30% of Labor Cost									112,128		123,341
Labor @ 10% of Labor Cost									37,376		41,114
Material @ 10% of Material Cost								160,940			177,034
Subcontract @ 5% of Sub. Cost							28,460				31,306
Total Direct Cost							597,651	1,770,337	523,263	668,484	3,915,708
Indirect @ 75% of Total Direct Labor Cost									392,447		431,692
Profit @ 5% of Total Direct Cost											195,785
Sub Total: Direct, Indirect, Profit											4,543,185
Health & Safety Monitoring @ 2%											90,864
Total Field Cost											4,634,049
Contingency @ 20% of Total Field Cost											926,810
Engineering @ 1% of Total Field Cost											46,340
Total Cost											5,607,199

YEAR	PW	CAPITAL	O&M COSTS	PRESENT
0	1.0000	5,607,199	0	$5,607,199
1	0.9346		24,783	$23,161
2	0.8734		24,783	$21,646
3	0.8163		24,783	$20,230
4	0.7629		24,783	$18,907
5	0.7130		24,783	$17,670
				$5,708,814

Based on a discount rate of: 7.00%

Notes:

1. Total costs are based on 1995 values used for Raymark Facility FS plus ten percent for inflation.
2. The source of the cost basis is NOT the Raymark Facility FS and the 10% inflation factor has not been applied.

TABLE 3
REVISED ALT. 3 - SCENARIO 2
EXCAVATION, HAULING, BACKFILLING AND SITE RESTORATION
RAYMARK- SHORE ROAD
STRATFORD, CONNECTICUT

Item	Qty	Unit	Unit Cost ($)				Total Cost ($)				Total Direct Cost, 1999 ($)[1]
			Sub.	Mat.	Labor	Equip.	Sub.	Mat.	Labor	Equip.	(Total Cost x 1.1)
MOBILIZATION/DEMOBILIZATION											
1) Office trailer (2)	10	MO	1,000				10,000				11,000
2) Storage trailer (1)	10	MO	500				5,000				5,500
3) Construction survey	1	LS	20,000				20,000				22,000
4) Portable communication equipment	4	SETS	1,500				6,000				6,600
5) Equipment mobilization/demobilization	1	LS	30,000				30,000				33,000
6) Site utilities	10	MO	4,000				40,000				44,000
7) Security	10	MO	10,000				100,000				110,000
8) Decontamination trailer	10	MO	1,500				15,000				16,500
DECONTAMINATION FACILITIES AND SERVICES											
1) Laundry service	48	WKS	250				12,000				13,200
2) Truck decon pad (2)											
a) Concrete pad - 8"	80	CY		70	125	5.00		5,600	10,000	400	17,600
b) Gravel base - 6"	60	CY		7.50	3.33	8.00		450	200	480	1,243
c) Curb	240	LF		3.07	1.99	0.05		737	478	12	1,349
d) Collection sump	2	EA		1,450	500	220		2,900	1,000	440	4,774
e) Splash guard	1,560	SF		1.25	1.00			1,950	1,560		3,861
3) Decontamination services	10	MO	1,200				12,000				13,200
4) Decon water	132,000	GAL	0.20				26,400				29,040
5) Personnel decon pad (2)											
a) Concrete pad - 4"	4	CY		70	125	5.00		280	500	20	880
b) Gravel base - 4"	4	CY		7.50	3.33	8.00		30	13	32	83
c) Curb	160	LF		3.07	1.99	0.05		491	318	8	899
6) Clean water storage tank (3000 gals)	2	EA		3,000	300			6,000	600		7,260
7) Spent water storage tank (5000 gals)	2	EA		5,000	400			10,000	800		11,880
LEGAL FEES											
1) Activity use limitations	1	DEED			2,500				2,500		2,500
SITE PREPARATION											
1) Prepare site for excavation at 35% of excavation costs	1	LS	58,616				58,616				58,616
SOIL EXCAVATION[2]											
1) Excavate contaminated soil	35,000	CY			1.74	2.61			60,900	91,350	167,475
2) Hauling excavated and S/S treated materials	39,000	CY			2.23	5.55			86,970	216,450	333,762
3) Backfill with clean soil											
a) Fill material	24,300	CY		18.00				437,400			481,140
b) Place & Spread	24,300	CY			0.51	1.87			12,393	45,441	63,617
c) Compact	24,300	CY			0.03	0.04			729	972	1,871
4) Backfill treated materials	16,000	CY			0.53	1.91			8,480	30,560	42,944
4) Sheet piling	4,500	SF	7.89				35,505				39,056
5) Asphalt Removal and Disposal											
a) pavement removal	4,056	SY			2.24	2.37			9,085	9,613	20,568
b) material transport	446	CY			3.00	7.40			1,338	3,300	5,102
c) disposal	446	CY			1.66	3.59			740	1,601	2,576
TEMPORARY STORAGE CELL											
1) Stressed Membrane Structure lease price (88' x 600')	36	MO		19,000				684,000			752,400
2) Material delivery to site	1	LS		9,000				9,000			9,900
3) 6" sand base (88'x 600' x 0.5')	978	CY		10.80				10,562			11,619
4) Geotextile floor (88' x 600')	5,867	SY		1.50				8,801			9,681
5) Erection costs											

TABLE 3
REVISED ALT. 3 - SCENARIO 2
EXCAVATION, HAULING, BACKFILLING AND SITE RESTORATION
RAYMARK- SHORE ROAD
STRATFORD, CONNECTICUT

			Unit Cost ($)				Total Cost ($)				Total Direct Cost, 1999 ($) [1]
Item	Qty	Unit	Sub.	Mat.	Labor	Equip.	Sub.	Mat.	Labor	Equip.	(Total Cost x 1.1)
a) scaffolding (rent for month)	72	MSF	90				6,480				7,128
b) labor (9 men, 25 days, 8 hr/day)	1,800	HR	25				45,000				49,500
c) construction consultant	1	LS	9,000				9,000				9,900
SITE RESTORATION											
1) Repave Lot	6,400	SF		1.14	0.20	0.17		7,296	1,280	1,088	10,630
2) Parking lot curbs	160	LF		0.47	0.80			75	128		224
3) Repave Shore Rd.											
a) 12" stone base	2,250	SY		15.40	0.58	1.18		34,650	1,305	2,655	42,471
b) 3" binder course	2,250	SY		3.89	0.41	0.35		8,753	923	788	11,509
c) 1" wearing course	2,250	SY		1.53	0.21	0.19		3,443	473	428	4,777
4) Revegetation (Lawns)	70	MSF		18.00	16.50	6.70		1,260	1,155	469	3,172
5) Revegetation (Trees and Shrubs)	25	EA			42.50				1,063		1,169
6) Restore stone/gravel surfaces (4-inch layer)	4,500	SY		7.70	0.35	0.71		34,650	1,575		39,848
7) Replace fence	800	LF		10.20	2.91	1.87		8,160	2,328	1,496	13,182
8) Sliding gate	12	LF		82.50	19.15	12.30		990	230	148	1,504
9) Swinging gate (3' wide)	1	EA		75.00	72.50	46.50		75	73	47	213
10) Rope fence											
a) 4' posts set in concrete	21	EA		6.25	10.25			131	215		381
b) rope	400	LF		3.00				1,200			1,320
11) Replace sidewalks											
a) 6" stone base	1,500	SY		7.70	0.35	0.71		11,550	525	1,065	14,454
b) 4" thick concrete	13,500	SF		0.96	0.97			12,960	13,095	0	28,661
12) Replace rip rap	360	TON		9.00	0.48	1.04		3,240	173	374	4,166
13) Place rip rap w/ heavy equipment	222	CY		15.40	6.70	8.00		3,419	1,487	1,776	7,350
14) Replace timber cribbing w/ concrete blocks											
a) Labor cost for placement (30' x 20')	600	SF			10.95				6,570		7,227
b) Crane rental for moving blocks	1	WK				1300.00				1,300	1,430
UTILITIES											
1) Grinder pump (Environment One model GP 2014-129)	1	EA		7,075.00				7,075			7,783
2) Alarm/Disconnect Panel (Environment One model MOD 260)	1	EA		1,000.00				1,000			1,100
3) Replace power pole	10	EA	1,457.00				14,570				16,027
4) Trenching	800	CY			1.93	1.44			1,544	1,152	2,966
5) Sewer pipe (force main, 1.5" PVC)	1,050	LF		0.93	1.88			977	1,974		3,246
6) Sewer Pipe Fittings (10% of cost of pipe)	1	LS		324.56				325			357
7) Water pipe (31-inch PVC)	1,100	LF		2.07	2.82			2,277	3,102		5,917
8) Water Pipe Fittings (10% of cost of pipe)	1	LS		591.69				592			651
INTERIM CONSTRUCTION MONITORING											
1) Stormwater Sampling	78	HR			25				1,950		2,145
2) Stormwater Analysis	6	EA	2,270				13,620				14,982
3) Air Monitoring (10 hr/wk x 48 weeks)	480	HR			25.00				12,000		13,200
4) Air Sample Analysis (6 @ 48 weeks)	288	EA	350				100,800				110,880
5) Sample Shipping	30	WK	100				3,000				3,300
6) ODCs/M&IE	30	WK				375				11,250	12,375
WELL REPLACEMENT/INSTALLATION											
1) Install 1 monitoring well	1	EA	6,000				6,000				6,600
2) Drilling Oversight	20	HR			25				500		550
3) Oversight ODCs/M&IE	1	LS				800				800	880
4) Construction Survey	1	LS	200				200				220

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RAYMARK- SHORE ROAD
STRATFORD, CONNECTICUT

Item	Qty	Unit	Unit Cost ($) Sub.	Mat.	Labor	Equip.	Total Cost ($) Sub.	Mat.	Labor	Equip.	Total Direct Cost, 1999 ($)[1] (Total Cost x 1.1)
Subtotal of Total Direct Costs							569,191	1,322,297	252,271	425,514	2,820,089
Safety Level (C) Multiplier (30% of labor & equipment)									74,931	127,654	202,585
Total with Safety Multiplier							569,191	1,322,297	327,203	553,168	3,049,044
Burden @ 30% of Labor Cost									98,161		107,977
Labor @ 10% of Labor Cost									32,720		35,992
Material @ 10% of Material Cost								132,230			145,453
Subcontract @ 5% of Sub. Cost							28,460				31,306
Total Direct Cost							597,651	1,454,527	458,084	553,168	3,369,772
Indirect @ 75% of Total Direct Labor Cost									343,563		377,919
Profit @ 5% of Total Direct Cost											168,489
Sub Total: Direct, Indirect, Profit											3,916,179
Health & Safety Monitoring @ 2%											78,324
Total Field Cost											3,994,503
Contingency @ 20% of Total Field Cost											798,901
Engineering @ 1% of Total Field Cost											39,945
Total Cost											4,833,348

Notes:

1. Total costs are based on 1995 values used for Raymark Facility FS plus ten percent for inflation.
2. The source of the cost basis is NOT the Raymark Facility FS and the 10% inflation factor has not been applied.

YEAR	PW FACTOR	CAPITAL COST	O&M COSTS	PRESENT WORTH
0	1.0000	4,833,348	0	$4,833,348
1	0.9346		24,783	$23,161
2	0.8734		24,783	$21,646
3	0.8163		24,783	$20,230
4	0.7629		24,783	$18,907
5	0.7130		24,783	$17,670
				$4,934,963

Based on a discount rate of: 7.00%